Differences in chemistry of the Ries area sediments and central European tektites revisited

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Based on their mutual chemical similarity, the sediments of the Upper Freshwater Molasse (Obere Süßwasser Molasse, OSM) are considered to be the major precursor material of tektites of the Central European Tektite strewn field (moldavites). The chemical differences between OSM sediments and moldavites have been evidenced and discussed. The explanations include (i) addition of components chemically distinct from OSM, (ii) changes to element ratios as a consequence of mass conversion to plasma and condensation to glass, and (iii) differences in volatility and/or condensation temperature of the elements.

In this study, a wide range of sediment types was analyzed including residual karst-type sediments, and data for a large range of elements were collected. Since the moldavites have extremely low contents of volatile compounds (e.g., H_2O, CO_2 or C_{org}), all sediment chemical data were recalculated to volatile-free compositions. The comparison of these recalculated sediment data and those of moldavites underscores earlier observations – enrichments in Cs, Ba, K_2O, and Rb, and depletions in many other elements including, e.g., transition metals, P, As, Sb, Mo in moldavites compared to OSM materials. These differences cannot be explained by a single process or factor.

New model of moldavite formation includes several consecutive steps: i. the parent mixture (OSM as dominant source) contains also minor admixture of organic matter and soils; ii. part of the ejected matter is converted to plasma, another part is directly melted on decompression; iii. following the decompression the separated vapor phase disintegrates glass to small droplets, some elements are partially lost (e.g., Fe, Cu, Zn) because of their volatily or volatily of their compounds like carbonyls; iv. large ions such as Cs^+, Ba^{2+}, K^+, Rb^+ from the plasma portion condense on the droplets; v. the droplets coalesce to larger tektite bodies and are reshaped by further glass flow.